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careers for bachelor graduates
in the
physical
sciences

WITH THE GOVERNMENT OF CANADA

DEPOSITARY LIBRARY
General Science
or Arts
(Mathematics and Physics)

Physics
Mathematics and Physics
Engineering Physics
Geophysics

Chemistry
Chemical Engineering

Geology
Geological Engineering

Mining and
Metallurgical
Engineering

The Canadian Government service offers the new physical science graduate the widest range of interesting and challenging careers in Canada.

This booklet will give you a brief insight into the career opportunities offered in the marine, atmospheric, and earth sciences; metals and minerals research; analytical and research chemistry; and export trade promotion.

Our interviewers will be on your campus during December and January and you are invited to meet with them to discuss these opportunities in detail.

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A Meteorological Officer briefs an aircrew on the weather conditions to be expected over their flight pattern.

The Dobson Ozone Spectrophotometer is used to measure the total ozone content of the atmosphere at a network of stations throughout Canada.



The ATMOSPHERIC SCIENCES

for graduates in:

General Science or Arts (Mathematics and Physics) Honours Physics, Mathematics and Physics and Engineering Physics

Each year, the Meteorological Service of the federal Department of Transport employs approximately 40 graduates in General Science or Arts with courses in Mathematics and Physics as Meteorological Officers, and 20 graduates in Honours Physics, Mathematics and Physics, or Engineering Physics as Meteorologists.

Although meteorology is one of the earliest of sciences, first studied some 2,000 years ago, only in the last 50 years has it developed its true nature as a science. The Canadian Meteorological Service, established in 1871, has developed at an accelerated pace since the Second World War. Today, this service has a full-time staff of about 2,200 providing accurate weather information to civilian enterprises and the armed forces. Headquarters of the Meteorological Service is in Toronto and principal weather offices are situated in Vancouver, Whitehorse, Edmonton, Winnipeg, Ottawa, Montreal, Halifax, Goose Bay and Gander. There are forecast offices at some 50 other centres throughout the country, many of which are attached to stations of the armed forces.

The Meteorological Officer in the Canadian Weather Service

As a new graduate in General Science or Arts, you are offered an excellent opportunity by the

Department of Transport to use your maths and physics in a professional career as a Meteorological Officer.

The newly appointed Meteorological Officer takes a formal in-service training course of approximately seven months and is then assigned to one of the civilian or National Defence forecast offices. He works at various aspects of weather prediction and provides specialized forecast services to aircrews and the public. He uses telephoto equipment to make various observations. He analyzes charts and forecast charts prepared at central offices, and uses this national data as well as locally prepared charts to focus his attention on specific local forecast problems. He prepares short-range forecasts by adaptation and refinement of the basic material and by special analytical techniques.

The Meteorological Officer may give meteorological training courses to the air force, or he may apply for an overseas posting with the R.C.A.F. or for assignment with the R.C.N. for ship and shore based meteorological services.

When he becomes more experienced and proficient, a Meteorological Officer may move up to senior posts in local or central forecast offices, or be employed in providing specialized meteorological services to agriculture, industry, or other government agencies. Many opportunities also exist for appointment as research associates in basic meteorological research, as directors of field research projects; in instrumentation design and development; and in data processing and statistical analyses.

The Meteorologist in the Canadian Weather Service

In the meteorological service the new graduate in Honours Physics, Physics and Mathematics, has an excellent opportunity to become a part of one of the most rapidly expanding scientific fields in Canada today.

A newly appointed Meteorologist takes a four week basic familiarization course and then, during the summer, is assigned to assist in some phase of meteorological research. In the fall, he enrolls, at full salary, in either the School of Graduate Studies, University of Toronto, or the School of Graduate Studies and Research, McGill University, where he undertakes studies leading to a Master's degree.

When he completes the two year Master's degree, most Meteorologists are assigned to weather prediction

duties at a major forecast office. Here the work involves rapid original analyses of data on a continental scale, by surface, radiosonde, satellite (or rocket) and radar observations. These analyses provide an orderly model of the atmospheric structure to which physical principles can be applied to determine the immediate and long-range state of the atmosphere.

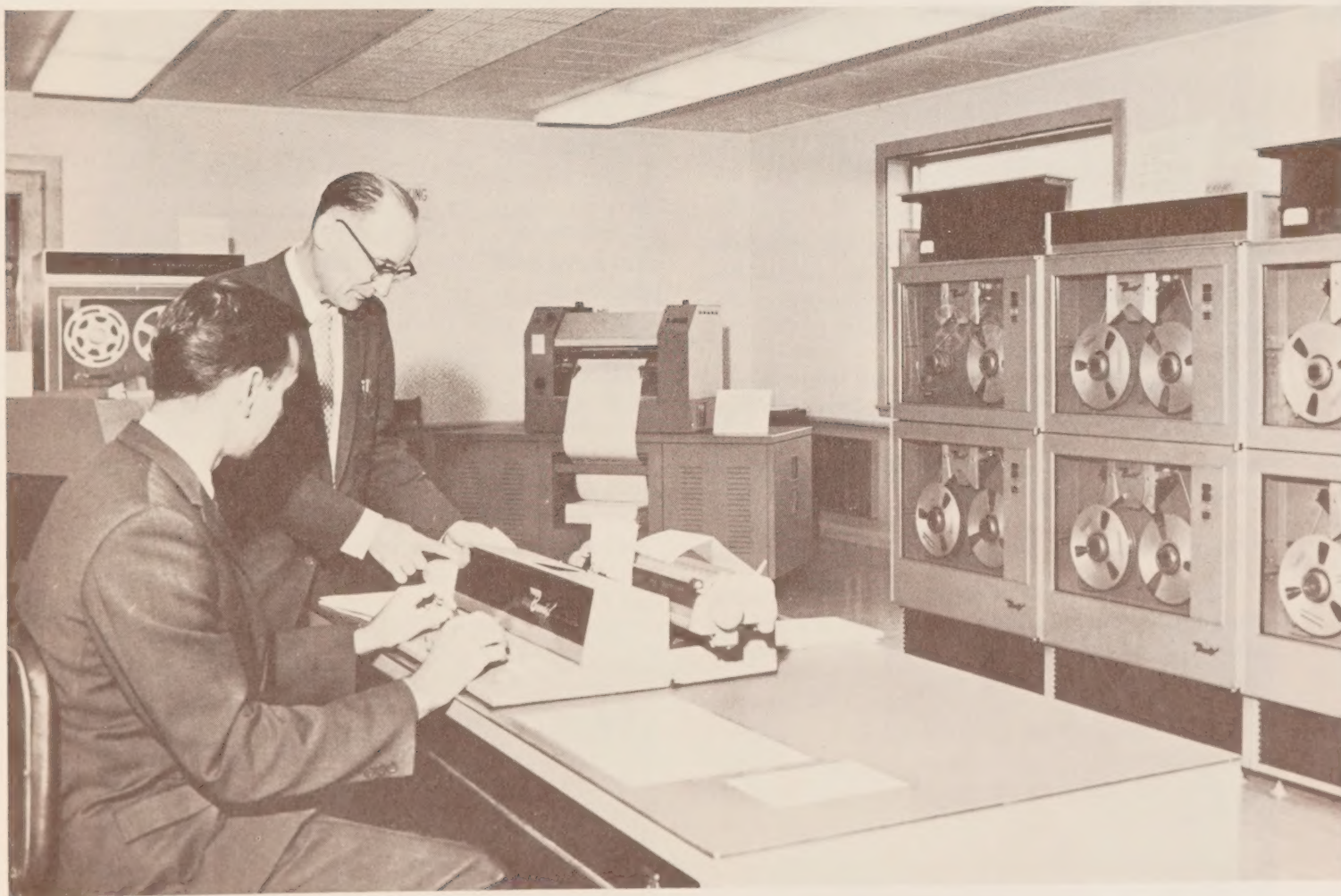
The practical experience gained solving problems associated with understanding and predicting the structure of the atmosphere is invaluable training for the Meteorologist in his advancement to more specialized duties concerning agriculture, industry, national defence, climatology, research and training, instrumentation development, or for equally responsible positions in the administration and direction of complex scientific programmes.



A Meteorologist puts the finishing touches on his prognostic chart preparatory to issuing a forecast.



MICROMETEOROLOGY — Instruments in a tobacco field in the Port Burwell area are used to facilitate a study of the tobacco fleck problem as a meteorological service to agriculture.



A view of the Computer Room at the Central Analysis Office, Montreal International Airport. The control console is shown at center. Other machines are, from the left, a paper tape station, a high speed line printer, and magnetic tape units. A High-speed Bendix G-20 computer (not shown) digests basic weather data at the rate of 100,000 computations per second and produces weather charts on the line printer.

The MARINE SCIENCES

for graduates in:

Physics, Geophysics, Engineering Physics

The new graduate in these fields who has an interest in sea and marine research will find the work of the Marine Sciences Branch of the Department of Mines and Technical Surveys of particular interest.

The main functions of this branch are to make studies to assist navigation especially in Arctic waters; to ascertain the resource potential of Canada's continental shelf; and to undertake extensive work in physical oceanographic research.

Instrumentation Design and Development

The many new facets of marine studies have created need for inventive Bachelor graduates in physics and engineering physics to work as research instrumentation design engineers and scientists. Their skills are of invaluable assistance in crossing the new frontiers of marine studies, and this strong support, by the scientific development of many complex measuring devices, requires the skill and knowledge of highly qualified physicists.

The majority of graduates engaged in this work are located at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Opportunities are expected to occur in other locations, however, as oceanographic activity increases on the west coast and on large inland water bodies such as the Great Lakes.

Marine Geophysicists

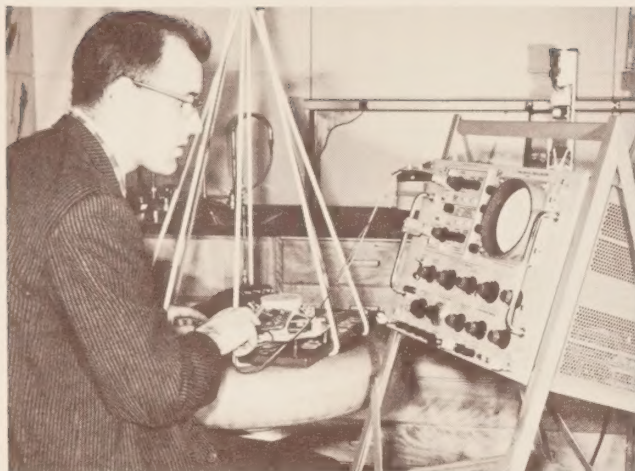
Geophysicists in the Marine Sciences Branch take part in research studies concerned primarily with the continental-oceanic boundaries and ridge systems of the ocean floor. They use total field magnetometers, ship borne gravimeters, seismic equipment and moored recording buoys. Much of the data is logged and digitized automatically for computer imports.

Although the nature of the work requires extensive periods at sea aboard ships such as the C.S.S. Hudson (illustrated on the opposite page) the environment at sea provides an unusual opportunity to work closely with the country's top scientists in this field.

Generous provisions for educational leave to take graduate studies in specialized fields are available to new graduates who demonstrate the ability and potential for research.



The Bedford Institute of Oceanography at Dartmouth, N.S., is the centre of Canada's oceanographic research. The Institute was opened in 1962, and is equipped to undertake oceanographic investigations in near shore waters, the high seas, and in far northern latitudes.



A member of the Bedford Institute's design staff works on a newly-designed accelerometer used to measure wave heights and periods. This instrument will be used in an important wave study of Canada's coastal waters and in the Great Lakes.



A delicate three-component thrust anemometer built at the Bedford Institute. This instrument is used for measuring wind structure.



The C.S.S. Hudson, Canada's newest addition to its oceanographic and hydrographic fleet, ranks among the finest geophysical vessels in the world.

Checking results of a geophysical survey 100 miles from the magnetic North pole.

* Footnote to Bachelor graduates contemplating graduate studies in Geophysics.

Each year, the Observatories Branch engages a number of graduates for assignments of about 15 months duration to field duties at a magnetic and/or seismic observatory in northern Canada. In these positions, they can expect to assemble, mount, operate and maintain complicated absolute recording equipment. Appointees undergo an initial three month training and familiarization period in Ottawa, after which they are assigned to a northern field station.

These appointments provide the recent graduate with an opportunity to obtain invaluable experience in geophysical observations and acquire sufficient funds to pursue post-graduate studies.



The GEOPHYSICAL SCIENCES

for graduates in:

Physics, Geophysics, Engineering
Physics, Electronics

The Observatories Branch of the Department of Mines and Technical Surveys offers the new graduate in the above sciences the challenge to devote his training to exciting scientific careers in:

Seismology

The *Seismology Division* maintains a chain of 11 seismograph stations across Canada for the study of local earthquakes and to co-operate in world wide studies of the earth's structure. A seismological laboratory and field organization is also operated for the study of the general nature of the earth's crust and its local irregularities.

Gravity

The *Gravity Division* makes gravity studies throughout the country which add to man's knowledge of the character of the earth's crust, the form of the geoid, and aid in geophysical prospecting. The division also develops instruments for measuring gravity at sea.

Geomagnetism

The *Geomagnetism Division* is concerned with the production of magnetic maps of Canada for navigation, surveying and geophysical prospecting. It maintains seven magnetic observatories and a magnetic laboratory

for the development and maintenance of magnetic instruments including an airborne magnetometer. The study of the magnetization of rocks is also part of the scientific work. This information is used to investigate the auroral zone, physical conditions of the ionosphere and inter-planetary space, and solar-terrestrial relationships.



Headquarters building at Ottawa, The Geological Survey of Canada.

The GEOLOGICAL SCIENCES

for graduates in:

Honours Geology and Geological Engineering

Each year a limited number of Bachelor graduates interested in the following fields of work are needed by the Geological Survey of Canada, the country's most important centre of laboratory research in geological science.

Groundwater

This work demands geology graduates with a strong background in Mathematics, Physics and Chemistry to study the hydrogeology of assigned areas. By carrying out drilling programmes, pumping tests and model studies, they make a framework for groundwater flow

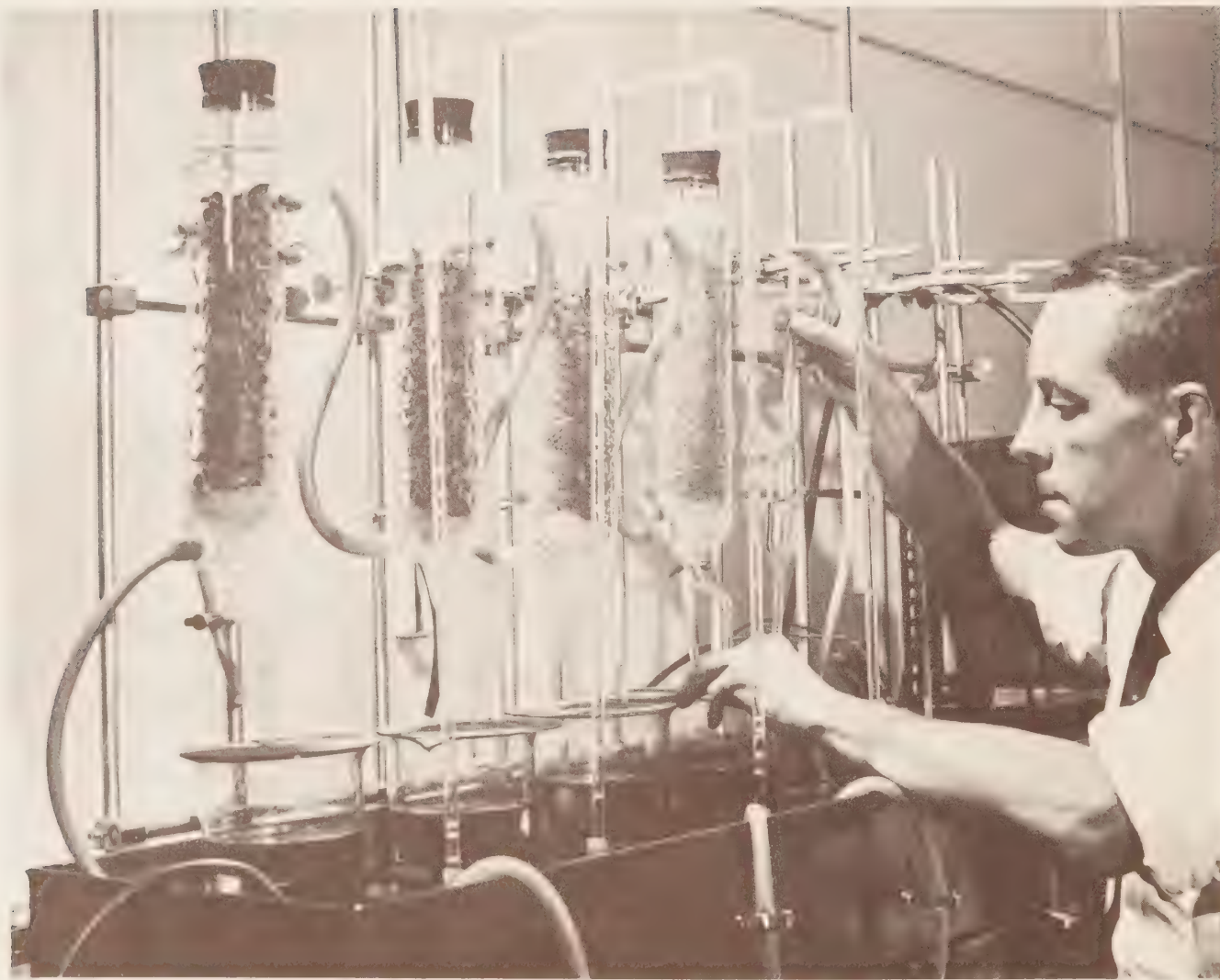
system studies both quantitative (water balance) and qualitative (chemistry). Over the next few years, the newly launched International Hydrologic Decade will require an increasing number of geologists in this specialized field.

Geophysics

Graduates in the *Geophysics Division* gather, compile and interpret geophysical data about the geology of Canada. They conduct research in some phases of geophysical work and seek to develop new techniques and instruments. Their work is organized under four sections: Magnetic Methods, Seismic Methods, Electrical and Radioactive Methods, and Instrumentation and Research.



Extensive use is made of helicopters to aid the work of the field geologist.



Extraction Metallurgy - Laboratory scale investigation of bacterial leaching in a recycling unit.

METALS and MINERALS RESEARCH

for graduates in:

Mining and Metallurgical Engineering, Geology and Geological Engineering

Graduates interested in the field of metals and minerals research will find challenging and rewarding opportunities with the Department of Mines and Technical Surveys. While the majority of officers engaged in research work in this department are graduates at the Master's and Doctorate levels, positions occur from time to time for those at the Bachelor's level. Generally, the work is in support of research scientists and, accordingly, these positions demand high calibre graduates. Graduates interested in the metals and minerals field will find highly specialized careers in the various divisions of this department, including extraction

metallurgy, physical metallurgy, fuels and mining practice, mineral sciences, and mineral processing.

Graduates with a special interest in mineral economics work in the Mineral Resources Division of the department. In value and variety, Canada is a world leader in mineral exports. Sixty-five minerals worth about \$32 billion are exported to more than 80 countries. High export earnings, enormous capital investment, and significant domestic employment are critically dependent on keeping our productivity and export markets in competition with increased mineral production elsewhere in the world. To maintain this, officers of the division make significant contributions to the minerals field by investigations into all phases of mineral production.

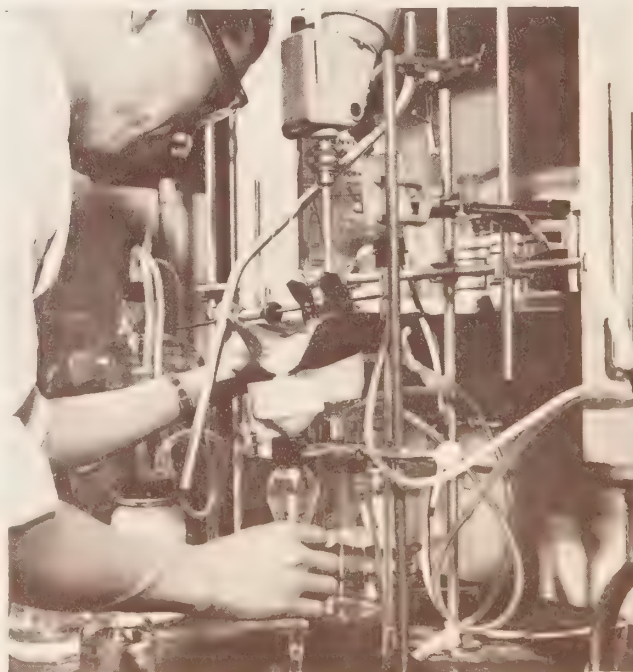
Canada's mineral production is increasing in value and mineral economists play an important role in this field.





View of the main petroleum laboratory—
Inspection Services Branch, Department of
National Defence.

MINERAL PROCESSING—Experimental flota-
tion cell to study the flotation characteristics of
minerals in a wide size range under closely
controlled conditions.



ANALYTICAL and RESEARCH CHEMISTRY

for graduates in:

Chemistry and Chemical Engineering

Wide range of career opportunities throughout Canada for new graduates in these field are offered:

In ANALYTICAL CHEMISTRY, graduates have a unique opportunity to work in well-equipped laboratories. They receive training and experience with equipment including spectrometry, ultra-violet and infra-red spectrophotometry, electro-chemistry, flame photometry, chromatography of all types, as well as with conventional wet-chemical analytical techniques. Most agencies, including the National Defence Inspection Services Laboratory, the Customs and Excise Laboratory and the Mineral Processing, Mineral Sciences and Geological Survey Laboratories offer the Analytical Chemist a diversity of analytical tasks. The graduate also has the opportunity to develop new analytical techniques where conventional methods are inadequate or new materials are to be investigated.

In RESEARCH CHEMISTRY, many opportunities exist for the new graduate in Chemistry or Chemical Engineering. High calibre graduates at the Bachelor's level may be assigned to teams of research scientists in various fields including high-temperature physical chemistry, the chemistry encountered in mineralogical and metallurgical technology, industrial waters chemistry, or the chemistry of wood, adhesives, and wood products. Graduates appointed in these areas who demonstrate potential and ability are encouraged to continue their training by educational leave.



In fuels and mining practice research, work extends from the design and operation of high-pressure pilot plant reactors for the study of hydrogenation desulphurization and hydro-cracking of heavy crude oils to the characterization of the molecular structure of oils and bitumens from physical properties



An officer of the Department of Trade and Commerce outlines the extent of a recent trade mission to South America to representatives of the metals industry.

EXPORT TRADE PROMOTION

for graduates in:

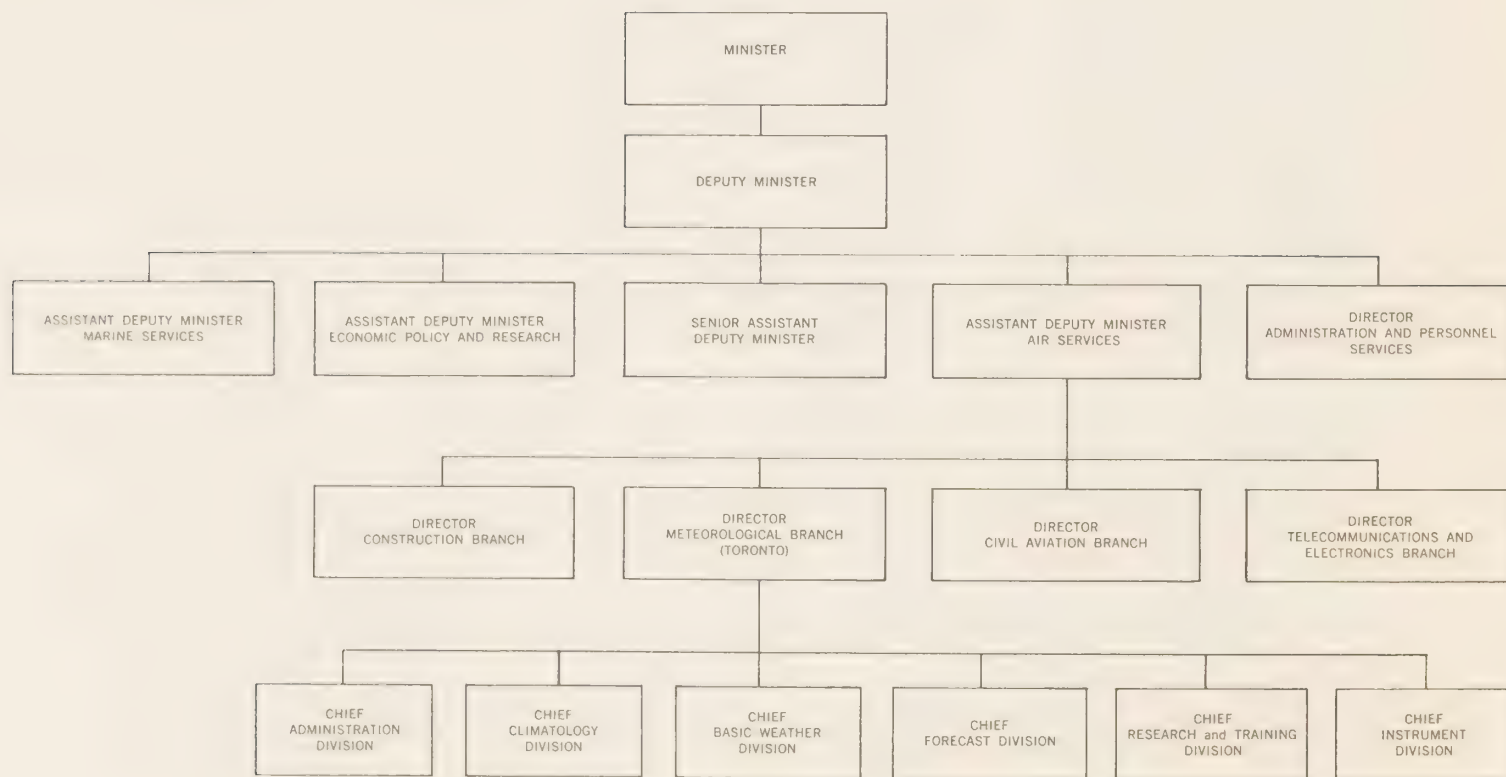
Mining and Metallurgical Engineering
Geology and Geological Engineering
Chemistry and Chemical Engineering

The Department of Trade and Commerce at Ottawa offers graduates in these fields the challenge of applying their technical training to broad administrative responsibilities in developing and directing activities to increase the opportunities for export by Canadian industry. Officers of the department work closely with the Canadian business community and assist industry in the export of its product. Early in his career the new graduate in this department is expected to take care of all aspects of a particular commodity industry, with a great degree of freedom and independence. Graduates are appointed to the various divisions of the Industrial Materials Branch, including the Chemical Division, the Metals and Minerals Division, the Forest Products Division, depending on their specialized training.

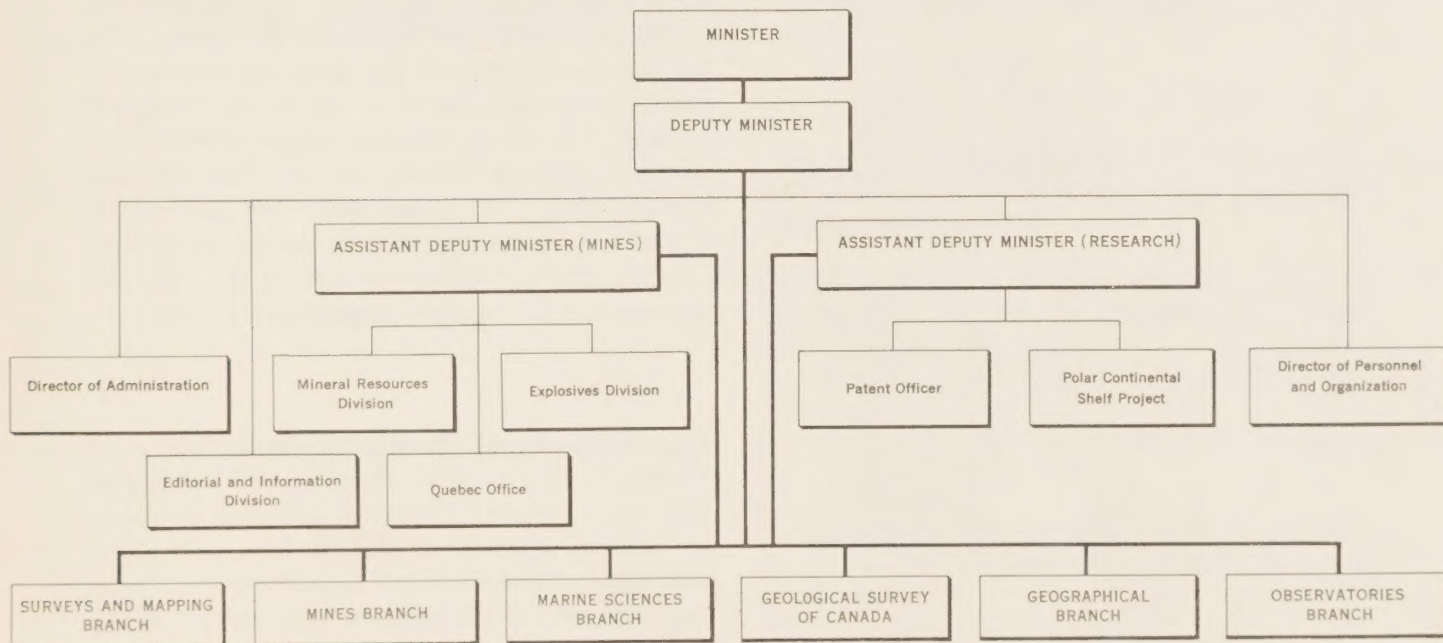
The new science or engineering graduate entering these divisions will work under and be trained by a senior officer of the department. He will be assigned certain industry commodities in his field of specialization and will compile and analyze data on domestic sources of supply, foreign demand and consumption, and study and report on market trends and develop-

ments abroad. He will assist with arrangements for participation of industry in trade fairs and trade missions abroad. He will be expected to become thoroughly familiar with all Canadian production and manufacturing in his commodity field by visiting plants and meeting with representatives of the industry.

CANADA
DEPARTMENT OF TRANSPORT



DEPARTMENT OF MINES AND TECHNICAL SURVEYS



Salaries

Salaries of graduates in the physical sciences in the Government service are usually increased annually, and adjusted periodically by cyclical review.

Benefits

The benefits are many and varied. Among these are 10 holidays a year plus three week's vacation. You will also earn 15 days of sick leave each year and if unused it will accumulate from year to year. You will be enrolled in one of the most comprehensive super-annuation plans in Canada and will have low cost term insurance. The pension under this plan can be as much as 70 per cent of your average salary over a six year period of highest earnings. If you wish, you may enrol in an excellent surgical-medical plan.

How to Apply

Recruiting teams visit Canadian universities from coast to coast during November, December and January of each year. Details of interview dates and locations, and application forms are available from your Placement Officer. Bulletin board announcements of these dates will also be displayed on your campus during late fall.

Selection

In the selection of graduates in the physical sciences, emphasis is placed on scholastic attainment, interests and personal suitability. A transcript of your university courses and marks should be included with the application.

Other Information

This booklet is one of a series prepared for university students. The others are:

- Biological Sciences
- Engineering
- Junior Executive Officers and Foreign Service Officers
- Medical Sciences, Dietetics and Social Work
- Law
- Library Science
- Business Administration, Commerce, Economics and Finance

Copies may be obtained from your University Placement Office or from any office of the Civil Service Commission, Ottawa 4.

Pamphlets describing current research activities in departments of the federal Government are also available in the following fields:

- Physical and Inorganic Chemistry Research
- Physics Research
- Chemistry Research in the Biological Sciences
- Entomological Research
- Bacteriology

Copies may be obtained from your University Placement Office or from any office of the Civil Service Commission.

Scientific Research

Summer Employment

The Government service begins its search for prospective employees long before they graduate. Each summer it employs students to work in its departments. In most instances the students receive travel assistance. Those working in the field receive allowances besides salary.

For further information and application forms, contact your University Placement Office. Please note that applications must be submitted before the last day of January.

